

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of Masaki YANAGIOKA

Application No.: 10/599,151

Filed: September 21, 2006

For: RUBBER COMPOSITION FOR TIRE TREAD AND PNEUMATIC TIRE
USING THE SAME

Group Art Unit: 1763

Examiner: John Uselding

Confirmation No.: 5036

DECLARATION UNDER 37 C.F.R. § 1.132

I, Masaki Yanagioka, declare that:

I am the inventor of the above-captioned patent application.

I received my Master of Engineering from the University of Tokyo in 2001, and I have been employed by Bridgestone Corporation since 2001, where I have been engaged mainly in research and development of fillers for a tire. Further, I received my Ph.D. of Chemical Engineering from Stanford University in 2009.

I have made the following experiments in order to evaluate wear resistance and low heat buildup of a rubber composition comprising carbon black having different hydrogen desorption ratio and CTAB (cetyltrimethylammonium bromide) surface area.

Experimental Procedure

<Production and evaluation of carbon black>

Carbon black of Additional Comparative Example A is prepared by using the carbon black producing furnace explained in FIGS. 1 and 2 of the present application. In the experiments, a fuel oil A having a specific gravity of 0.8622 (15°C/4°C) is used as a fuel, and a heavy oil having properties shown in Table 1 of the present specification is used as a starting oil. The operating conditions in the carbon black producing furnace are shown in the following Table B.

With respect to the resulting carbon black, the CTAB surface area, hydrogen desorption ratio and toluene tinting permeability are measured according to the methods described in the specification of the present application. Results are shown in the following Table B.

<Production and evaluation of rubber composition>

A rubber composition is prepared according to a compounding recipe shown in Table 4 of the present specification by using the resulting carbon black. This rubber composition is vulcanized in a pressure type vulcanizing apparatus at a temperature of 145°C for 30 minutes.

With respect to the resulting rubber composition, the wear resistance and low heat buildup are measured according to the methods described in the specification of the present application. Results are shown in the following Table B.

For reference, the operating conditions and the results of Examples 3 and 9 and Comparative Example 2 in the specification of the present application are shown again in the following Table B.

Table B

		Example 9	Additional Comparative Example A	Comparative Example 2	Example 3
Conditions for introducing stock oil	Introduction amount (kg/hr)	345	367	290	290
	Pre-heating temperature (°C)	178	178	190	195
Conditions for introducing air	Total air amount introduced (kg/hr)	1250	1251	1495	1389
	Pre-heating temperature (°C)	590	592	603	602
	Amount of fuel introduced (kg/hr)	59	59	73	68
Residence time t1 (sec)		0.0062	0.0072	0.0060	0.0045
Residence time t2 (sec)		0.065	0.062	0.057	0.064
Average reaction temperature T1 (°C)		1351	1381	1572	1535
Average reaction temperature T2 (°C)		1200	1164	1121	1336
Reaction ratio α (sec·°C)		8.38	9.94	9.40	6.91
Reaction ratio β (sec·°C)		78.0	72.2	63.9	85.8
CTAB surface area (m ² /g)		75	75	138	140
$0.260 - 6.25 \times 10^{-4} \times (\text{CTAB})$ (%)		0.21	0.21	0.18	0.17
Hydrogen desorption ratio (%)		0.26	0.17	0.18	0.23
Toluene tinting permeability (%)		92	92	99.8	98.5
Wear resistance (index)		75	74	105	115
Low heat buildup (index)		116	116	95	102

Summary

As seen from Table B, when the CTAB surface area is 111-200 m²/g and the hydrogen desorption ratio is larger than $0.260 - 6.25 \times 10^{-4} \times \text{CTAB}$ (wt%), the high wear resistance and low heat buildup of the rubber composition can be simultaneously established. Even when the hydrogen desorption ratio is larger than $0.260 - 6.25 \times 10^{-4} \times \text{CTAB}$ (wt%), if the CTAB surface area is less than 111 m²/g, the wear resistance of the rubber composition deteriorates.

I declare further that all statements made herein of my own knowledge are

true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 10/13/2011

Declarant: Masaki Yanagioka
Masaki Yanagioka